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June 18, 1995

by FAX only

ATTN.: **MARQUETTA**
Group Art Unit 2600
U. S. Patent & Trademark Office
Washington, D. C. 20231

RE: serial 08/046,335 (Bowker and Lubard)

Dear Marquetta:

With this note I am sending a 14-page DRAFT amendment.

Please do NOT have this DRAFT amendment entered!

Instead please deliver it directly to Examiner Bryan Tung, Art Unit 2615.

Thank you very much.

Sincerely,

Peter I. Lippman

accompanying: draft amendment for Mr. Tung

Entry authorized by Peter I. Lippman by telephone interview (6-19-95)
6/19/95

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Kent BOWKER and Stephen LUBARD	Group Art Unit:
Serial No.:	08/046,335	2615
Filed:	April 12, 1993	
For:	"UNDERWATER IMAGING SYSTEM"	
Our docket:	xAA-05	Examiner Bryan S. Tung

SUPPLEMENTAL AMENDMENT
under Rule 116

Hon. Commissioner of Patents
and Trademarks
Washington, D. C. 20231

Sir:

Further responsive to the Official Action dated November 15, 1994, please amend this application as follows.

IN THE CLAIMS:

Please cancel claims 39, 73, and 94 through 98, without prejudice.

In claim 40 at line 1, please change "39" to --36-- .

In claim 74 at line 1, please change "73" to --33-- .

Please change claims 33, 78, 83, 36, 38, 88, 56, 89, 64 66 and 67, all to read as indicated below. (For the Examiner's convenience the foregoing list is in the requested claim order, and as they appear below.)

Please Enter
6/19/95

6.

33. (twice amended) A [n imaging] system for imaging [forming an image of] a volume [thin section] of a turbid medium, namely an [thin section of] ocean volume, with objects therein, said system being for use with means for bodily transporting at least part of the system with respect to said turbid ocean volume, and said system comprising:

means for projecting a pulsed thin-fan-shaped beam to selectively illuminate, along an illumination-propagation direction, a thin section of such turbid ocean volume;

a streak tube, having a cathode for receiving reflected light back, approximately along the illumination-propagation direction, from the thin section of turbid ocean volume; said streak tube also having an anode end, and comprising:

first electronic means for forming at the anode end of the streak tube successive thin-strip-shaped electronic-image segments of the light successively received on the cathode from the illuminated turbid-ocean-volume thin section, and

second electronic means for distributing the successive thin-strip-shaped electronic-image segments, along a direction generally perpendicular to a long dimension of the image segments, across the anode end of the streak tube,

said distributing of the electronic-image segments being in accordance with elapsed time after operation of the beam-projecting means so that each thin-strip-shaped electronic-image segment is displaced from an edge [side] of the anode end of the tube substantially in proportion to total propagation distance and time into and out from the turbid-medium thin section, to form a composite electronic image of the turbid-ocean-volume thin section as a function of propagation depth;

means for imposing a substantially common spatial definition and directional restriction, in one dimension, upon (1)

the pulsed thin-fan-shaped beam projected by the projecting means and (2) the reflected light received back from the thin section of turbid ocean volume;

means for sequentially operating the beam-projecting means, during operation of such bodily-transporting means, to project a sequence of beam pulses to illuminate successive thin sections, and generate a corresponding sequence of composite electronic images; and

means for processing the composite electronic images to produce a corresponding sequence of composite optical images, ~~and for visually displaying the sequence of composite optical images~~ which can be displayed to show a motion picture that emulates visual perceptions of travel through the successive thin sections of turbid ocean volume.

~~78.~~ 12. (amended; follows claim 77) The system of claim ~~38~~ 5, in combination with such bodily-transporting means; and wherein:

said combination further comprises the bodily-transporting means; and

the bodily-transporting means comprise [comprising:] means for bodily displacing the beam-projecting means and streak tube together, along a direction generally perpendicular to a long dimension of the thin section of turbid ocean volume

[, while sequentially operating the beam-projecting means to project a sequence of beam pulses to illuminate successive thin sections, and generate a corresponding sequence of composite electronic images;

means for processing the composite electronic images to produce a corresponding sequence of composite optical images, and for visually displaying the sequence of composite optical images to show a motion picture that emulates visual perceptions of travel through the successive thin sections of turbid ocean volume].

~~83.~~ 17. (amended; to follow claim 82) The system of claim ~~39~~ 5, wherein:

said beam-projecting means effectively illuminate such objects in the thin section of turbid ocean volume;

said beam-projecting means do not effectively illuminate portions of the thin section of turbid ocean volume immediately behind such objects;

said cathode effectively receives said reflected light back from such illuminated objects;

said cathode does not effectively receive reflected light back from the thin section of turbid ocean volume immediately behind such objects;

said composite electronic image<u>s and composite optical images</u> include[s] images of such illuminated objects, and of the turbidity in the thin section of turbid ocean volume, arising from said effectively received reflected light; and

said composite<u>-optical-image motion picture</u> [electronic image] includes shadow images behind such illuminated objects, arising from absence of effectively received reflected light from said thin section of turbid ocean volume immediately behind such illuminated objects.

18.

~~36.~~ (twice amended) A [n imaging] system for imaging [forming an image of] a volume [thin section] of a turbid medium, namely an [thin section of] ocean volume, with objects therein, said system being for use with means for bodily transporting at least part of the system with respect to said turbid ocean volume, and said system comprising:

means for projecting a pulsed thin-fan-shaped beam to selectively illuminate, along an illumination-propagation direction, a thin section of such turbid ocean volume; said beam penetrating and propagating within the thin section during a first range of times corresponding to beam propagation depth into the thin section;

a streak tube, having a cathode for receiving reflected light back, approximately along the illumination-propagation direction, from the thin section of turbid ocean volume during a second range of times corresponding to total propagation distances into and out from the thin section approximately along the illumination-propagation direction; said streak tube also having an anode end, and comprising:

first electronic means for forming at the anode end of the streak tube successive thin-strip-shaped electronic-image segments of the light successively received on the cathode from the illuminated turbid-ocean-volume thin section, at particular times corresponding to the particular total propagation distances for particular penetration depths, and

second electronic means for distributing the successive thin-strip-shaped electronic image segments, along a direction generally perpendicular to a long dimension of the images, across the anode end of the streak tube in accordance with said second range of times corresponding to total propagation distances into and out from the thin section of turbid ocean volume, to form a composite electronic image of the turbid-ocean-volume thin section as a function of propagation depth;

means for imposing a substantially common spatial definition and directional restriction, in one dimension, upon (1) the pulsed thin-fan-shaped beam projected by the projecting means and (2) the reflected light received back from the thin section of turbid ocean volume;

means for sequentially operating the beam-projecting means, during operation of such bodily-transporting means, to project a sequence of beam pulses to illuminate successive thin sections, and generate a corresponding sequence of composite electronic images; and

means for processing the composite electronic images to produce a corresponding sequence of composite optical images, and for visually displaying the sequence of composite optical images to show a motion picture that emulates visual perceptions of travel through the successive thin sections of turbid ocean volume.

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20. ~~38.~~ (twice amended) The system of claim ~~39~~ 19, in combination with such bodily-transporting means; and wherein:

said combination further comprises the bodily-transporting means; and

the bodily-transporting means comprise [comprising:] means for bodily displacing the beam-projecting means and streak tube together, along a direction generally perpendicular to a long dimension of the thin section of turbid ocean volume

[, while sequentially operating the beam-projecting means to project a sequence of beam pulses to illuminate successive thin sections, and generate a corresponding sequence of composite electronic images; and

means for processing the composite electronic images to produce a corresponding sequence of composite optical images, and for visually displaying the sequence of said composite optical images to show a motion picture that emulates visual perceptions of travel through the successive thin sections of turbid ocean volume].

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88. (to follow claim 87) The system of claim 36, wherein:

said beam-projecting means effectively illuminate such objects in the thin section of turbid ocean volume;

said beam-projecting means do not effectively illuminate portions of the thin section of turbid ocean volume immediately behind such objects;

said cathode effectively receives said reflected light back from such illuminated objects;

said cathode does not effectively receive reflected light back from the thin section of turbid ocean volume immediately behind such objects;

said composite electronic images and composite optical images include[s] images of such illuminated objects, and of the turbidity in the thin section of turbid ocean volume, arising from said effectively received reflected light; and

said composite-optical-image motion picture [electronic image] includes shadow images behind such illuminated objects, arising from absence of effectively received reflected light from said thin section of turbid ocean volume immediately behind such illuminated objects.

31. 18
~~56~~. (amended) The system of claim ~~36~~, wherein:

[further comprising: means for displacing the beam-projecting means and streak tube together, along a direction generally perpendicular to a long dimension of the thin section of turbid medium, while sequentially operating the beam-projecting means to project a sequence of beam pulses to illuminate successive thin sections of turbid medium, and generate a corresponding sequence of composite electronic images; and]

said composite-image processing and sequence-displaying means comprise [for using the sequence of composite electronic images as an emulation of video data recorded in travel through the successive thin sections of turbid medium; said using means comprising] means selected from the group consisting of:

means for using the sequence of composite electronic images to display a video sequence that emulates visual perceptions of travel through the successive thin sections of turbid ocean volume, and

means for recording the sequence of composite electronic images to be used later in displaying such a video sequence.

32.
~~89~~. (amended; follows claim 56) The system of claim ~~56~~ 31, in combination with such bodily-transporting means; and wherein:

said combination further comprises the bodily-transporting means;

the bodily-transporting [displacing] means comprise an aircraft supporting the beam-projecting means and streak tube together and flying above the turbid ocean volume along a [said] direction generally perpendicular to a long dimension of the thin section of turbid ocean volume;

said beam-projecting means project said sequence of beam pulses downward from said aircraft, through air above the turbid ocean volume, and then downward into the turbid ocean volume; and

said reflected light received back from the thin section of turbid ocean volume passes upward from the turbid ocean volume, through air above the turbid ocean volume, to said aircraft.

38
~~84~~. (twice amended) A [n imaging] system for imaging a volume [for forming an image of a thin section] of a turbid medium, namely an [a thin section of] ocean volume, with objects therein, said system being for use with means for bodily transporting at least part of the system with respect to said turbid ocean volume; said system comprising:

means for projecting a pulsed thin-fan-shaped beam to selectively illuminate a thin section of such turbid ocean volume;

a streak-tube cathode for receiving reflected light back, approximately along the illumination-propagation direction, from the thin section of turbid ocean volume;

means for focusing the reflected light onto the streak-tube cathode substantially directly;

said focusing means comprising:

(1) no "glass plate stack" image slicer for optically mapping portions of said reflected light onto portions of a light-receiving surface, and

(2) no other type of image slicer for optically mapping portions of said reflected light onto portions of a light-receiving surface, and

(3) no pixel-encoding fiber bundle for optically mapping a two-dimensional reflected image into a line image, and

(4) no other pixel-encoding fiber bundle for optical mapping of a reflected image, and

(5) no other optical image-mapping device other than basic optical elements such as a lens or mirror; [and]

streak-tube means, responsive to the focused reflected light, for forming therefrom a corresponding composite electronic image of the turbid-ocean-volume thin section as a function of propagation depth;

means for restricting the light received by the streak-tube cathode, from the focusing means, to substantially only reflection directly from said selectively illuminated thin section;

means for sequentially operating the beam-projecting means, during operation of such bodily-transporting means, to project a sequence of beam pulses to illuminate successive thin sections, and generate a corresponding sequence of composite electronic images; and

means for processing the composite electronic images to produce a corresponding sequence of composite optical images ~~and for visually displaying the sequence of composite optical images~~ which can be displayed to show a motion picture that emulates visual perceptions of travel through the successive thin sections of turbid ocean volume.

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40. ~~66.~~ (amended) The system of claim ~~65~~ 39, in combination with such bodily-transporting means; and wherein:

said combination further comprises the bodily-transporting means; and

the bodily transporting means comprise [comprising:] means for displacing the beam-projecting means and streak-tube means together, along a direction generally perpendicular to a long dimension of the thin section of turbid oecean volume

[, while sequentially operating the beam-projecting means to project a sequence of beam pulses to illuminate successive thin sections of turbid ocean volume, and generate a corresponding sequence of composite electronic images;

whereby the electrooptical means produce a corresponding sequence of composite optical images; and

means for displaying the sequence of composite optical images to show a motion picture that emulates visual perceptions of travel through the turbid-ocean-volume thin section].

41.

~~57.~~ (amended) A method of imaging a turbid medium, namely an [thin section of] ocean volume, with objects therein, said method comprising the steps of:

projecting a pulsed thin-fan-shaped beam to selectively illuminate, along an illumination-propagation direction, a thin section of such turbid ocean volume;

then at a substantially common location with the projecting step, receiving reflected light back, approximately along the illumination-propagation direction, from the thin section of turbid ocean volume;

the projecting and receiving steps imposing a substantially common spatial definition and directional restriction, in one dimension, on the thin-fan-shaped beam and received reflection;

forming successive thin-strip-shaped image segments which are respectively images of the reflected light successively received along approximately the illumination-propagation direction;

distributing the successive thin-strip-shaped image segments, along a direction generally perpendicular to a long dimension of the images;

said distributing of the image segments being in accordance with elapsed time after the beam-projecting step so that each thin-strip-shaped image segment is displaced from a common baseline position substantially in proportion to total propagation distance and time into and out from the turbid ocean volume, to form a composite image of the turbid-ocean-volume thin section as a function of propagation depth;

shifting said common location in a direction roughly at right angles to both (1) a long dimension of the thin-fan-shaped beam and (2) the illumination-propagation direction;

repeating all of the above steps multiple times to form multiple composite images of progressively encountered turbid-ocean-volume thin sections as a function of propagation depth; and

visually displaying the multiple composite images sequentially to show a motion picture that emulates visual perceptions of travel through the turbid ocean volume along said direction of said shifting step.

REMARKS

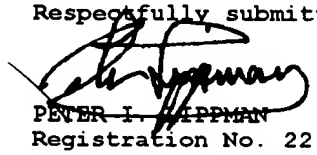
Applicants wish to thank Examiners Tung and Chin for the courtesy of extended telephone interviews, and for having indicated that the claims would be allowable if revised to incorporate claim 73 and the substance of the final paragraph of claim 78 into all the claims. The claims have been so revised, without prejudice, and are believed to be now in condition for allowance.

The Appendix sheet summarizes claims and dependencies as Applicants understand the case now stands (as amended).

Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully request the Examiner's allowance of all the claims now standing in this case. In addition it is asked again that, should any further obstacle to allowance appear, the Examiner telephone the undersigned attorney to try to resolve the obstacle.

Respectfully submitted,



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June 18, 1995

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Appendix

showing claim dependencies ("/" means "depends from")

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